Value Added Packaging and Nutritional Quality Evaluation of 'Beauregard' Sweetpotatoes for Improved EU Market Penetration

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Nature of Market Issue

Per capita consumption of sweetpotatoes in the U.S. has not increased during the last 30 years. Nevertheless, opportunities for increased domestic market expansion exist. In addition, excellent opportunities are available for marketing U.S. sweetpotatoes in several international destinations, including Europe. The focus of this project was to analyze the market situation in the United Kingdom (U.K.) for sweetpotatoes, identify opportunities for U.S. exports, and conduct value-added packaging and nutritional quality evaluations of U.S.-grown 'Bearegard' sweetpotatoes for improved U.K. / E.U. market penetration.

Project Approach to the Market Issue

The project used a multi-faceted approach to address the market issue, including a U.K. market analyses, identification of shipping carton and retail market packaging preferences, sweetpotato arrival quality constraints, research on value-added packaging materials, and product quality/nutritional evaluation.

Contribution of Public Agency Cooperators

The LSU Agriculture Center provided the services of Dr. David Picha and Dr. Roger Hinson to conduct the project. Both individuals have more than 20 years of professional experience in postharvest care and marketing of sweetpotatoes. The Louisiana Department of Agriculture & Forestry provided the services of Mr. Bryce Malone, marketing director for the Louisiana Sweetpotato Commision.

Project Results:

U.K. Market Analyses

An analysis of the sweetpotato market situation in the U.K. and several other E.U. importing countries was conducted over a two year period from late 2002 through the fall of 2004. The majority of the market analyses work focused on the U.K., since it is the dominant sweetpotato market in Europe and the entire volume is imported. All the major sweetpotato importers, wholesalers, and retailers were identified and interviewed to obtain data on the past, present, and forecasted sweetpotato market situation.

A significant change has occurred in retail marketing of sweetpotatoes in the U.K. during the last several years. All the major supermarket chains (i.e. Tesco, Asda, Sainsburys, Morrisons, Safeway, Somerfield, Waitrose, and Marks & Spencer) have started to stock orange flesh sweetpotatoes on a year around basis in their individual stores throughout Britain. This represents a dramatic shift from the situation prior to 2002, in which only some of the retailers stocked sweetpotatoes, and many of these were

white flesh types. Currently, the sweetpotato is experiencing one of the most rapid increases in per capita consumption among all fresh produce items. Although sweetpotatoes are still a minor vegetable in the U.K. market, the leading supermarket chain in the UK indicated that among all fresh vegetables, the growth rate in sales of sweetpotatoes leads all other products. The forecast among importers and retailers is for continued steady growth in market demand.

Sweetpotato import volume into the U.K. has increased from slightly less than 4,000 metric tons in 1997 to 11,000 metric tons in 2002. Import volume from the leading supplier, the U.S., increased more than 4,500 metric tons during this time period, and continues to increase. All U.K. supermarkets obtain their sweetpotatoes through an importer, rather than purchasing directly from the grower/exporter. The vast majority of sales are for conventionally-grown product, although there is a steadily increasing market demand for organically-grown sweetpotatoes. All sweetpotato suppliers selling product to the major British retail chainstores must comply with EurepGap requirements beginning in 2005.

Although the U.S. is the principal supplier of sweetpotatoes to the U.K., several other countries have become formidable competitors in recent years, including Israel, Egypt, and South Africa. Israel is now the principal supplier of orange-fleshed sweetpotatoes to the U.K. during the fall months. Recently, Brazil and China have begun exporting sweetpotatoes to the U.K. The typical Caucasian British consumer prefers orange-flesh roots and purchases them from retail supermarkets, which represent 56% of all fresh produce sales in the U.K. This is in contrast to the ethnic immigrant sector of the populace from various countries in Asia, Africa, and the Caribbean. Consumers from this minority demographic group typically prefer white-flesh sweetpotatoes and often make their purchases from independent grocers or street markets. Although this group constitutes less than 5% of the population, they have the highest per capita consumption of sweetpotatoes in the U.K.

Shipping Carton Preferences

British and E.U. importers prefer sweetpotatoes packed in either a 6- or 10-kg double-walled fiberboard carton. This smaller carton contrasts to the larger 18-kg (40-lb) carton used for marketing sweetpotatoes in the U.S., and the one most commonly used to pack sweetpotatoes for the U.K. This size container is standard for the North American market, but is too large for the U.K. market. The majority of competing suppliers against the U.S. for the U.K. market pack in 6-kg or 10-kg cartons. Importers are averse to receiving sweetpotatoes in the 18-kg carton and they all indicated it is very important for U.S. suppliers to pack in 6-kg cartons in order to maintain market share. Sweetpotatoes packed in 6-kg cartons are ready for direct display on the shelves of the retail store, while sweetpotatoes packed in 18-kg cartons have to be re-packed into the smaller 6-kg retail display cartons. This takes time and requires expensive labor, adding cost to the product. Re-packing also adds another handling step to the product, increasing the likelihood of incurring physical damage, bruising injury, and concomitant decay to the sweetpotato.

Additional problems identified by British importers with the 18-kg carton used by most U.S. exporters include: weak physical strength, carton collapse, poor carton stacking arrangement the pallet, and inadequate ventilation through the stacked layers of cartons on the pallet. Adequate ventilation openings on the sidewalls are necessary to

allow for appropriate temperature and relative humidity management during sea transport. This aids in preventing surface mold development during transit and distribution. Surface mold was routinely observed on roots packed in inadequately ventilated 40-lb cartons.

Retail Packaging Preferences

Sweetpotatoes are repacked by the importer according to the specifications of the retailer. The large supermarket chains usually display sweetpotatoes in bulk and/or in perforated plastic consumer bags weighing 500 gm, 750 gm, or 1 kg. Large size roots (350 to 450 gm) are preferred for bulk displays, while medium size (150 to 200 gm) roots are preferred for consumer bags. Three to 5 roots are typically put in a bag, depending on total weight. Blocky shaped roots are preferred over elongated ones. Surface skinning is undesirable. Most retailers indicate demand for bagged sweetpotatoes is increasing faster than bulk displayed roots due to the convenience factor. This is positive for U.S. growers as it provides a generally high-priced fresh export market outlet for small roots which can only be marketed as canners in the U.S.

Sweetpotato Arrival Quality Constraints

The principal constraints in U.S. sweetpotato arrival quality in the U.K. were identified to be: root shrivel, surface mold, excess root skinning, dull skin color, physical damage/bruising injury, irregularity in root size and shape within a carton, and various forms of decay. Consistent supplies of high quality roots are essential in order to expand U.S. presence in the U.K. / E.U. market.

Value-added Packaging Research

The use of shrink wrap plastic films is a form of convenience packaging and a way to add value to the export marketed product. Shrink wrap films can either be used to over-wrap small cartons, or more commonly, to over-wrap individual roots. The principal manufacturers of shrink wrap film, sealing equipment, and heat tunnels were identified. Two shrink wrap plastic films (Cryovac D955 and Clysar EHC75) were evaluated for use as individual root wraps and as over-wrapping materials for 2.3 kg (5-lb) consumer packs of fresh roots. Film-wrapping was done by a manual L-bar sealer, followed by passing the individual roots or cartons of roots through a hot air tunnel (85°C for 6 seconds). Weight loss was significantly higher in sweetpotatoes from non over-wrapped cartons. Roots inside packages over-wrapped with EHC75 film consistently had less weight loss than roots held inside D955 overwrapped cartons. After 6 weeks of storage at 22°C, roots inside EHC75 overwrapped cartons lost 45% less weight compared to roots from unwrapped cartons. Roots inside D955 overwrapped cartons lost 30% less weight compared to roots from unwrapped cartons. Sucrose concentration was significantly higher in roots from overwrapped cartons compared to non-overwrapped carton roots. Film overwrapping of consumer packs can maintain product quality and improve market life of exported sweetpotatoes.

Several different consumer bag types were evaluated for retail marketing of sweetpotatoes. The objective was to determine if bag type significantly influences root postharvest quality and weight loss. The bagging treatments analyzed were: unwrapped control, perforated polyethylene, nylon mesh, and paper window-bags. Results indicated

that the sweetpotatoes packed in polyethylene bags had significantly less weight loss and root shrivel compared to the other bagging treatments. However, flavor quality was similar among the bagging treatments.

Postharvest decay is one of the principal sources of market loss of sweetpotatoes. Decay may develop gradually during long distance transport and is accentuated by physical damage to the root, skinning, inadequate carton ventilation, and improper temperature management. Several postharvest treatments were evaluated to determine their effect on reducing decay of sweetpotatoes. Beauregard sweetpotato roots were dipped in a fungicide (2,6-dichloro-4-nitroaniline), hot water (55°C for 5 minutes), or a combination of both treatments prior to packing in the export cartons. The postharvest hot water treatments were effective in reducing the incidence of decay. Sweetpotatoes marketed organically in the EU will accept the postharvest use of hot water.

Quality/Nutritional Evaluation

An increasing amount of British consumers are giving preference to consuming high nutritional value foodstuffs. Sweetpotato cultivars from the principal exporting nations to the U.K. were analyzed for compositional analyses and nutritional quality. The cultivars analyzed were Rubina (orange skin/orange flesh from Israel), Beauregard (orange skin/orange flesh from Louisiana), Kumara (purple skin/white flesh from New Zealand), Bosbok (purple skin/white flesh from South Africa), Quarter Million (light brown skin/white flesh from Jamaica), and several unknown cultivars from Brazil and Peru. The tissue was extracted, dried, and prepared for carbohydrate, mineral, and Vitamin A analyses using spectrophotometric and chromatographic procedures. A wide range in composition existed among the leading cultivars marketed in the E.U.

Results of nutritional analysis of the leading sweetpotato cultivars exported to Europe indicated the Beauregard cultivar from Louisiana ranks favorably compared to the other cultivars exported to the U.K. It contains a higher concentration of carotenoids (precursors of Vitamin A) than the other leading orange flesh competing cultivars exported to the EU. Protein and mineral element analyses also indicated Beauregard ranked equal to the competing cultivars. The high nutritional value, especially Vitamin A, and desirable flavor of Louisiana Beauregard sweetpotatoes are qualities of the cultivar that retailers feel are important to increasing demand in the U.K. Beauregard contained a higher sugar content and significantly better flavor than the leading orange flesh competing cultivar, 'Rubina', from Israel. Results of Vitamin A analyses revealed Beauregard to have a higher concentration. The high nutritional value, especially Vitamin A, and desirable flavor of Louisiana Beauregard sweetpotatoes are favorable qualities of the cultivar that may be used as a marketing tools to increase demand in the U.K.

Current or Future Benefits Derived from Project

The U.K. sweetpotato market demand, market opportunities, product quality requirements, and packaging preferences were determined during the course of this project. The U.K. is currently the second most important export market for U.S. sweetpotatoes. Significant market growth potential exists and the information generated from this project will be beneficial to U.S. growers/exporters interested in expanding their market presence in the U.K. The project also identified substantial future market opportunities in other E.U. countries. Sweetpotato consumption in Germany, France, the

Netherlands, Belgium, Scandinavia, and several of the newly admitted countries to the E.U. is just beginning to expand. Information on the market requirements, market access, and potential export opportunities in the U.K. /E.U. is an important aspect of initiating and enhancing export volume for U.S. sweetpotatoes.

Individual shrink wrap packaging of sweetpotatoes has the potential to extend market life and add value to the fresh root. It has gained importance in marketing fresh produce in the U.S. and the E.U. This may be attributed to increased product convenience, perceived improved product sanitation, and diminished spread of postharvest decay. Adding value to sweetpotatoes and improving their convenience of use has generated considerable interest among the larger U.S. sweetpotato grower/shippers. Several of these grower/shippers have requested assistance in the design and technology for shrink wrapping sweetpotatoes to extend their market opportunities. In addition, several of the large retail chains in the U.S. and EU have expressed considerable interest in obtaining consistent supplies of shrink wrapped sweetpotatoes for marketing in their individual stores.

The details of the protocol and technology for handling and shrink wrapping sweetpotatoes were provided to several sweetpotato packinghouses in Louisiana and inquiries were also received from other states. This resulted in the adoption and application of this value-added technology for marketing sweetpotatoes. The demand for shrink wrapped sweetpotatoes is anticipated to significantly increase in the future. Market price obtained by the grower/shipper for shrink wrapped sweetpotatoes is consistently higher than unwrapped roots and currently more than offsets the equipment and additional labor costs needed for shrink wrapping.

Nutritional information on the main sweetpotato cultivars marketed in the UK and EU is very limited. Consumers are becoming increasingly aware of the positive health implications of consuming sweetpotatoes, but have no nutritional information available to help them decide which type or cultivar of sweetpotato to purchase. The information generated from this project will be useful in promoting the high quality of U.S. 'Beauregard' in the U.K. market against competing cultivars.

Additional Information Available

A comprehensive detailed report of the U.K sweetpotato export market situation, sources of competition, list of importers, wholesale markets, retail markets, product quality requirements, packaging preferences, and additional information pertinent to exporting U.S. sweetpotatoes is in preparation. The report will be made available for publication in the U.S. Sweetpotato Council newsletter and distributed to each of the state sweetpotato associations. Specific components of the project study will be submitted for publication in various trade and scientific journals.

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